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Agricultural Research Administration
Bureau of Entomology and Plant Quarantine

I N S E C T P E S T S U R V E Y

Special Supplement (1949, No. 5)

Issued July 15, 1949

X MORTALITY OF EUROPEAN CORN BORER LARVAE DURING
THE WINTER OF 1947-48 IN ILLINOIS, IOWA,
MINNESOTA, AND WISCONSIN X

- by -

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The information included herein was obtained during the spring of 1948 in the course of a Federal-State cooperative survey and educational program conducted largely with financial assistance from the Office for Food and Feed Conservation to aid farmer insecticide and equipment manufacturers, and others in determining if, where, and when insecticides should be applied to corn for the control of the European corn borer. The data were supplied by the Illinois Natural History Survey, Illinois Agricultural Experiment Station, Iowa Agricultural Experiment Station, Office of the Minnesota State Entomologist, Minnesota Agricultural Experiment Station, and Wisconsin Agricultural Experiment Station, and assembled at the Toledo office of the Bureau of Entomology and Plant Quarantine. Early in the spring it became evident from the surveys that there had been an unusually high mortality of hibernating corn borer larvae during the winter, in many instances the highest on record. This high mortality is thought worthy of special record because winter mortality among these larvae is ordinarily very low.

The observations in overwintered larvae were made in March, April, and early May and consisted of counts of borers in corn remnants in various types of fields. The number of specimens observed was dependent, to a large extent, upon the abundance of borers in the locality being examined.

Mortality of the Overwintering Larvae

In Illinois observations were made in 17 counties in the northern half of the State. The mortality varied from 0 to 66 percent per county, and was higher in standing stalks than in stalks that were down. In standing stalks as high as 79 percent of the borers were dead. The more northern counties had higher mortalities than those to the south, and the average for dead borers was 30 percent in the 17 counties.

In Iowa observations were made in 17 northeastern counties. In most counties 25 specimens were observed in each of 5 fields. The mortalities in the various counties ranged from 38 to 87 percent, and increased northward. The average for all counties was 58 percent. About half of the larvae were from standing, and half from disked, stalks. In several fields more than 90 percent of the borers were dead, and in one count of 25 all were dead. A total of 1,985 specimens was observed in 79 locations.

The observations made in Iowa extended through June and included a diversity of source fields. Special studies of these data did not show any definite trend in percentage mortality either upward or downward as the season progressed when county data were studied by districts, although the April and early May mortality records averaged slightly higher than those taken later in the season.

In Minnesota a series of counts of borers was made in each of 35 counties in the southeastern part of the State. A total of 4,039 specimens in 108 locations was observed, of which 81 percent were dead or died soon after being taken to the laboratory. All borers were dead in some small counts, and in several other counts ranging from 100 to 200 specimens 90 percent were dead. Higher mortalities were encountered in the more northern counties, but the proportion of dead borers did not differ as much from the northern to the southern part of the State as in Illinois and Iowa.

When arranged according to the treatment of fields, the borer mortality averaged slightly higher in those unpicked or hand-picked than in those machine-picked. Low-lying stalks contained fewer dead than were found in standing stalks, probably because they were under cover of snow during part or all of the winter.

The Wisconsin observations were made at 181 locations in 48 counties, and a total of 2,525 specimens were examined. The borer mortality in the various counties ranged from 21 to 100 percent, with a general average of 66 percent. The average borer mortality was higher in the northern than in the southern counties. In this respect the situation was similar to that in Minnesota. Mortality data for the 4 States are summarized in Table 1.

Table 1.--Winter mortality of European corn borer larvae in Illinois, Iowa, Wisconsin, and Minnesota counties as observed in the spring of 1948^{1/}

State and Counties	Mortality Percent	State and Counties	Mortality Percent	State and Counties	Mortality Percent
ILLINOIS:		WISCONSIN: (cont'd)		MINNESOTA:	
Jo Daviess	47	Pierce	96	Isanti	97
Winnebago	36	Pepin	82	Chisago	96
Carroll	66	<u>Eau Claire^{2/}</u>	100	Sherburne	82
Ogle	54	Buffalo	74	<u>Anoka</u>	70
De Kalb	20	Trempealeau	50	Wright	86
Du Page	59	Jackson	74	Hennepin	78
Henry	29	Wood	43	<u>Washington</u>	76
Bureau	32	Portage	88	Renville	92
Mercer	39	Waupaca	66	McLeod	78
Stark	17	Outagamie	38	Carver	88
Henderson	20	Brown	21	Scott	90
McDonough	0	<u>Kewaunee</u>	32	Dakota	88
Knox	12	La Crosse	69	<u>Sibley</u>	70
Kankakee	38	Monroe	83	Redwood	92
Iroquois	22	Juneau	64	Brown	74
Vermilion	10	Adams	67	Nicollet	75
<u>Champaign</u>	11	Wausara	70	Le Sueur	76
Average.....	30	Marquette	87	Rice	85
IOWA:		Green Lake	74	Goodhue	72
Worth	87	Winnebago	51	<u>Wabasha</u>	78
<u>Winneshiek</u>	77	Fond du Lac	46	Cottonwood	92
Cerro Gordo	78	Manitowoc	29	Watsonwan	69
Floyd	74	<u>Sheboygan</u>	11	Blue Earth	85
Franklin	66	Crawford	74	Waseca	80
Butler	42	Vernon	78	Steele	81
Bremer	65	Richland	74	Dodge	79
Grundy	53	Sauk	81	Olmsted	81
Black Hawk	41	Columbia	62	<u>Winona</u>	63
<u>Delaware</u>	62	Dodge	76	Jackson	84
Marshall	38	Washington	40	Martin	77
Tama	40	<u>Ozaukee</u>	69	Faribault	81
Benton	53	Grant	51	Freeborn	80
Linn	51	Iowa	58	Mower	82
Jones	54	Dane	77	Fillmore	80
<u>Jackson</u>	55	Jefferson	61	<u>Houston</u>	77
Johnson	43	Waukesha	79	Average.....	81
Average.....	58	Milwaukee	55		
WISCONSIN:		Lafayette	69		
Washburn	-	Green	76		
Polk	100	Rock	88		
<u>Barron^{2/}</u>	100	Walworth	90		
St. Croix	80	Racine	54		
Dunn	59	<u>Kenosha</u>	34		
Chippewa	67	Average.....	66		

^{1/} Arranged in order of location in the State from north to south. Counties in same latitude are grouped between lines.

^{2/} Five specimens or less.

Causes of the Mortality

The causes of the high mortality cannot be definitely determined but it is believed that the peculiarities of the 1947 growing season and of the following winter were largely responsible. The 1947 planting season was late because farm operations in early spring were delayed by the prevailing cool, wet weather. Many poor stands of corn resulted, and numerous fields were plowed under and planted to other crops. These conditions probably delayed growth of the corn more than they did the development of the borer and resulted in poor synchronization of the insect with its host, and a possible reduction in number of first-generation larvae. The early wet period was followed by unusually hot and droughty conditions, which at first favored the delayed crops but later damaged corn in some localities and probably were unfavorable to borer development.

The late summer and early fall weather was ideal for maturation of crops, and much late corn produced excellent yields. In contrast to the effect of the first part of the season on the first generation of borers, these conditions favored the second generation, enabled it to approach its potential abundance. This was shown by the cooperative fall surveys of corn borer abundance in 1947. Phenomenal increases in numbers of borers had taken place in several localities. In Minnesota, populations in comparable areas increased from 9 borers per 100 plants in 1946 to 273 borers per 100 plants in 1947. Increases were reported in Illinois, Iowa, and Wisconsin, though not nearly so great as in Minnesota. Large numbers of second-generation larvae were still immature at the beginning of winter, however, and others may not have been physiologically ready to withstand the rigors of the severe winter that followed. As shown in Table 2, a greater proportion of the larvae were found immature in the fall survey of 1947 than in the two previous years in all of the States except Illinois. In that State a higher proportion of the larvae observed in the fall of 1945 were immature than were observed in 1947. In 1947 only 70 percent of the larvae were mature in Illinois, 63 percent in Iowa, 26 percent in Minnesota, and 49 percent in Wisconsin. These proportions are undoubtedly related to late deposition of second-generation eggs, abundance of immature second-generation borers, and late maturation of the corn.

Table 2.—Proportion of immature European corn borer larvae observed in fall abundance surveys in 1945, 1946, and 1947.

Fall	Immature larvae, instars I - IV, inclusive			
	Illinois	Iowa	Minnesota	Wisconsin
	Percent	Percent	Percent	Percent
1945	35	26	<u>2</u> /26	18
1946	10	15	60	23
1947	30	<u>1</u> /37	74	51

1/ Districts 3, 6, 9, and 12.

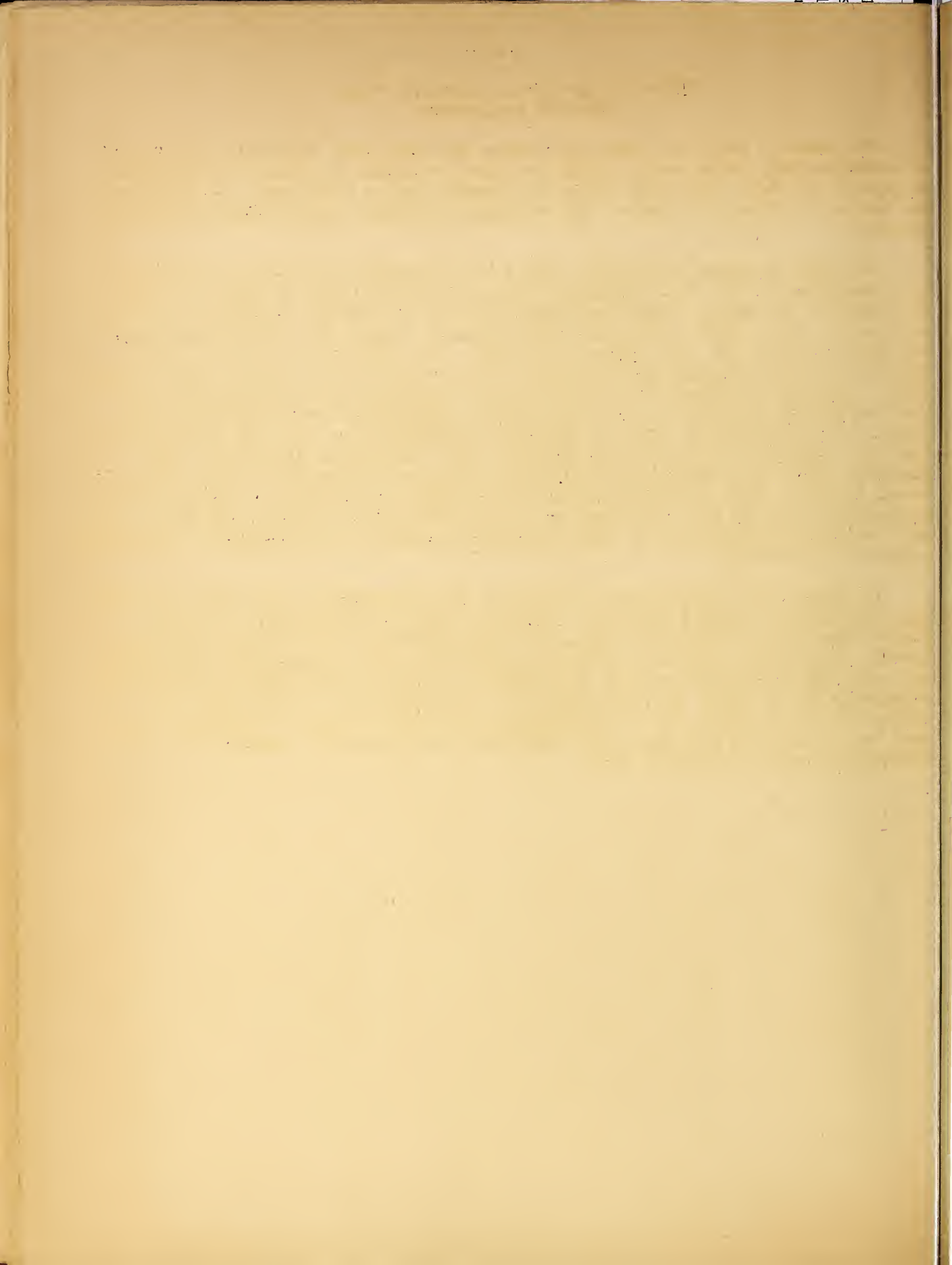
2/ Only 43 specimens.

Effect of the Winter Mortality Upon the 1948 Populations

The areas in which the mortality counts were made, and the average percentage of overwintering larvae dead in each, are shown in figure 1. There are some discrepancies at State lines, but these are probably due to differences in timing and method of making the counts, and combining individual county figures into area averages.

The areas in which population increases or decreases in 1948 were indicated by a comparison of the fall abundance survey of 1948 with that of 1947 are shown in figure 2. It appears from this comparison that the average populations in 1948 were lower than in 1947 in Minnesota and Wisconsin, higher than in 1947 in Iowa, and about the same for both years in Illinois. The decreases in Minnesota were greatest in the previously most heavily infested section in the eastern part of the State. Increases occurred in the western part where populations were lowest the year before and also where some of the highest mortalities were recorded in the spring. In Wisconsin the areas of increase and decrease are not well defined but increases occurred in the northern counties where the highest mortalities were observed. Decreases occurred in northeastern Iowa where populations were comparatively heavy in 1947, and increased in the remainder of the State. Illinois populations followed the same trend as in the other States showing a decrease in the most heavily infested areas of 1947 in northern counties and increasing in the central counties of the State.

It appears that populations of borers in 1948 increased in some areas in which high mortalities occurred during the previous winter, and decreased in others. Similar fluctuations occurred in areas in which mortalities were not greatly above normal. In general, decreases in borer populations were recorded where populations had been relatively high in 1947, and increases occurred where infestations had been relatively low in 1947. To what extent the high mortalities of the winter of 1947-48 were responsible for the decreases, and whether or not the increases would have been larger had the high winter mortalities not prevailed, cannot be determined from the available data.



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